

# Improving Communications

## Recommendations for the National Ocean Service E-Mail System

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## INTRODUCTION

The National Ocean Service (NOS) is undertaking a review of its administrative and management activities. During the initial briefings provided to the newly-arrived head of NOS (Dr. Nancy Foster), numerous NOS managers indicated that the e-mail communications system was a major source of frustration. NOS tasked the Logistics Management Institute (LMI) to assess the e-mail systems in place within NOS to determine whether improvements were needed and, if so, whether they could be accomplished through better use of current assets or whether a new system was needed. In addition, LMI was to identify how any proposed revised system would be maintained.

We participated in two meetings with NOS e-mail administrators only. Then we conducted interviews over a period of a few weeks with a representative number of NOS employees from various divisions or groups (30 people) in their offices, both at Silver Spring, MD, and in field locations (Seattle; Port Angeles, WA; and Charleston, SC). In most cases, we used a questionnaire (Appendix A) as a starting point for the interviews. We sent the questionnaire to prospective interviewees as an attachment to an e-mail message, thereby helping to test the capability of the system.

## ASSESSMENT

### General

Our interviews revealed that NOS system administrators believed that the e-mail system worked properly, while many users believed that their systems did not. In

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fact, both groups are correct. The systems do work well, in a technical sense, but NOS does not have the policies, procedures, or technical support structure in place to ensure that users will be able to get satisfactory results. The new NOS Chief Information Officer (CIO), Hugh Johnson, noted that, from the user's perspective, if a message cannot be sent, then the system does not work (even if the reason is that the user does not know how to use it).

We found that the NOS e-mail systems work well as they are as long as central address registries can be kept current. NOS does need to make improvements in two areas: user training and problem resolution. Also, although not mandatory, upgrading the e-mail system infrastructure to a Web-based system would bypass the problems inherent in operating on both PC and Macintosh platforms. All of these issues should be addressed in a general set of e-mail policies and procedures that need to be developed, promulgated, and enforced under the direction of the NOS CIO. That would provide the necessary administrative infrastructure to support the hardware and software infrastructure already in place.

## Problems

Based on our interviews, we identified and investigated four general problem areas: difficulty with attachments, multiple e-mail addresses and lists, inadequate user support, and unclear system administration responsibilities.

### DIFFICULTY WITH ATTACHMENTS

Some users complained that, although they could receive attachments with e-mail, they often could not "open" an attachment. We found that, in general, this occurs when the attached file is created with an application, or some version of an application, the message recipient does not have. This results from not adhering to the NOS standard for e-mail attachments (for example, the NOS standard for document attachments is WordPerfect 6.1). Because of the functional linkages across NOS, many employees must receive numerous documents, spreadsheets, and other attachments from throughout NOS, and employees will often be unable to open documents because the sender has not converted the document to the NOS standard format. About a year ago, there were problems getting the attachments at all, but the users universally acknowledged that receiving attachments was no longer a problem—users sometimes just could not open them.

### MULTIPLE E-MAIL ADDRESSES AND LISTS

Several users expressed frustration that they had multiple e-mail addresses or had to consult multiple directories to find someone. We found that the National Oceanic and Atmospheric Administration (NOAA) maintains an "X.500" directory that aliases everyone's e-mail address to the standard NOAA e-mail address convention, which is *firstname.lastname@noaa.gov*. (A spot check did show that some NOS people were not in the directory, however, so NOS needs to be vigilant

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to make sure the directory is kept accurate.) This means that every NOS employee's e-mail address is structured in the same way. But many users do not know this and, further, many do not know that they should set their "reply to" address in their client to this address. (The term *e-mail client* refers to the portion of the e-mail software that runs on the user's workstation.) As a result, some users perceive they have multiple addresses, some of which do not appear to work.

The NOAA central registry system works well—as long as new users are recorded there. That does not always happen. Users also have to constrain themselves to giving out only one e-mail address.

Many users are keeping a Banyan e-mail client, in addition to their other primary e-mail client, in order to retain their mailing lists to various people in NOAA and even the Department of Commerce, which were pure Banyan networks in the past.<sup>1</sup> This is inefficient and unnecessary. These Banyan mailing lists can be transferred or converted to whatever native format is required by the user's primary e-mail client. If the user's primary client does not have the required level of capability with respect to mailing lists, then the client should be upgraded.

Some organizations, for example, the Coast Survey/Oceanographic Products and Services Division (CS/OPSD), have very primitive e-mail clients with a poor user interface. These clients also do not handle address books or mailing lists and do not automatically uudecode or uuencode attachments. However, CS/OPSD will soon be upgrading to a much better client.

Seattle established and is effectively using local newsgroups to discuss events as they happen. Unfortunately, a user has to be explicitly set up with an account with the appropriate permissions in order to participate. This user newsgroup e-mail entity is distinct from the user's NOS e-mail account. But this newsgroup paradigm could be extended to all of NOS, and the need for a separate account could be eliminated, if NOS were to set up a Web-accessible page using Hypermail (see <http://www.eit.com/software/hypermail/>) or a similar package.

## INADEQUATE USER SUPPORT

Several users complained that their e-mail client would not let them do things that other people were doing. We found that those users generally did not know how their e-mail client worked or how it fit into the e-mail system. Therefore, some users were not aware of how to do some things they wanted to do or some of the capabilities of the system. This problem could be solved by user training, or by making an electronic bulletin board or a frequently asked questions (FAQ) list available to the various e-mail clients via the Web. These inexpensive solutions would help users learn how to use the system to full advantage.

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<sup>1</sup> Banyan, Inc., produces software.

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## UNCLEAR SYSTEM ADMINISTRATION RESPONSIBILITIES

Users often did not know whom to contact for support or were dissatisfied with the support received. We found that, in many cases, the system administrator work was believed to be merely an unofficial collateral duty of one particularly knowledgeable staff member.

There is no overall schematic or diagram of the NOS e-mail system. Such a diagram would make it easier to see potential bottlenecks and redundancies and to assign management responsibility fairly. A diagram showing the servers, connectivity, geographic location, and ownership would be a very useful tool for managing and improving the NOS e-mail system.

Some e-mail system administrators are perceived as either not caring about their customers' problems, especially those of NOS employees who are at geographically remote locations, or neglecting to keep some or all of their customers informed of system changes or upgrades. This points out the need to let all NOS employees know that they are responsible for understanding how to operate their e-mail client. But when a problem arises that the user cannot solve, the user should know which person is responsible for ensuring that the problem is solved as soon as possible.

The NOS staff members are largely scientists with excellent technical and analytical skills. For a variety of professional reasons, each staff member has become firmly convinced of the superiority of PC or Macintosh computers for their needs. As a result, the agency has groups, both between and within divisions, in which one model or the other predominates. Some PC e-mail client administrators are reluctant to work with Macintosh e-mail clients, and vice versa. E-mail administrators need to be well versed in the platforms and software of the users who are their responsibility. If some of their users have PCs and some have Macs, the administrator needs to know how to work with both platforms.

## Capabilities

NOS has the capability to resolve all of its e-mail problems quickly and simply without the need for major hardware or software procurements. By most federal agency standards, NOS has personnel who are highly proficient with their computers. NOS also has a relatively modern suite of hardware and software:

- ◆ Almost anyone in NOS can e-mail anyone else in NOS. The e-mail infrastructure provides connectivity for everyone in NOS (with the possible exception of some small, remote field locations), and NOAA does a fairly good job of maintaining the central address registry.
- ◆ Almost everyone has Web access and a browser, or can get it. This will allow an easy fix to the problem of user instruction and support questions,

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as an appropriate Web site can be developed to serve as the first place to check for e-mail questions. Use of Web technology would also solve the platform problem and facilitate a future shift from the existing decentralized NOS e-mail system to an easier-to-manage centralized model.

- ◆ NOS has established source software standards for e-mail attachments, even though continuing attention is needed.
- ◆ NOAA's e-mail gateway does a good job of transferring mail between different e-mail systems and clients, as can be seen with the disappearance of problems relating to attachments.
- ◆ NOAA has established a Web site that has directories with every NOS employee's e-mail address listed.

## RECOMMENDATIONS

Again, the NOS e-mail system works well (in a technical sense), even in the face of multiple hardware and software configurations. Most of the current problems could be resolved inexpensively with improved user support and better delineation of system administration roles.

### Short Term

We recommend the following actions to resolve current issues.

#### USER SUPPORT

- ◆ All NOS employees should know who their e-mail administrators are. They should rely on those administrators to solve any e-mail problems.
- ◆ User e-mail training should be made available for any e-mail client that NOS supports. This training should be part of the orientation of new employees.
- ◆ Make FAQ lists available via the Web for each e-mail client.
- ◆ NOS should explore the possibility of using internal NOS Internet mailing lists and electronic bulletin boards for dissemination of information.

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## SYSTEM ADMINISTRATION

- ◆ Each entity in NOS must have an assigned e-mail administrator, all reporting (for e-mail purposes) to the NOS Chief Information Officer.
- ◆ Each e-mail administrator should be held accountable for the e-mail operations and training of assigned users, whether or not those users are at remote locations.
- ◆ NOS should produce a schematic diagram of their e-mail system.
- ◆ NOS must enforce (or at least publicize) an e-mail attachment standard. If it proves too difficult to enforce the standard format, NOS could make conversion utilities available for downloading via the Web or use embedded conversion scripts at the server level.<sup>2</sup>
- ◆ NOS should take a look at setting up a File Transfer Protocol (FTP) server for transferring large files or attachments, instead of including them in an e-mail message, especially if the message is addressed to multiple recipients.
- ◆ NOS should either convert a copy of a raw Banyan e-mail address file to each of the principal mail client address book formats, or, in the worst case, have someone type the addresses into a text file. In either case, the file of addresses can be made available via a local drive or the Web for users to copy and paste or import into their client environment. This would eliminate the need to maintain the Banyan e-mail clients only for their addresses.
- ◆ NOS should determine a minimal set of required e-mail technical functionality and make sure that every subordinate organization is in compliance. This would include establishing a preferred e-mail client that is known to be reliable, and enforcing the addressing convention and the standard formats for attachments.
- ◆ NOS should allow subordinate organizations to use a different or enhanced approach to e-mail capabilities as long as they are able to maintain 100 percent communication capabilities with the rest of NOS and they have the expertise to support their system enhancements.

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<sup>2</sup> It should also be possible to set up a program or script to which a user could send an attachment, then the program or script would send the attachment back in the standard format, which the user could then send to the intended recipient. This would save the user the trouble of having to download and learn how to use a local copy of a conversion utility. If the user sends a format that could not be converted, the program or script could e-mail a message to an e-mail administrator, who would then know the program or script needs upgrading.

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## Long Term

We recommend that NOS eliminate the confusion and technical support of multiple clients and platforms by moving to a Web-based e-mail system. That would require centralizing the e-mail capability with a Web-based Post Office Protocol (POP) or Internet Message Access Protocol 4 (IMAP4) set of servers with browser-type e-mail clients.

The cost of this option would be relatively low, as NOS already owns the servers (in fact, the existing multiple mail servers could probably be consolidated) and the network infrastructure is already set up. Additional costs would only be for the POP or IMAP4 software, and the training of the administrators and the users to learn the new system. (See Appendix B.)

All any NOS employee would then need is an IMAP4-compatible mail client, a Web browser, and access to the Web. Adoption of this recommendation would eliminate compatibility problems. Netscape Communicator, for \$59, has the IMAP4-compatible e-mail client included for PC, Mac, and UNIX platforms. Microsoft's Internet Explorer 4.0 is free, but only the PC platform is currently supported. There are other IMAP4-compatible clients available, some free. Each NOS division/group could choose their own client, as long as it met the agreed upon NOS baseline technical capability. It would be much easier for the e-mail administrators, however, if everyone had the platform-specific version of the same client.

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## APPENDIX A. NOS E-MAIL SURVEY QUESTIONS

The following questionnaire was e-mailed to NOS interviewees to prepare them for the interviews and to test the functioning of the e-mail system.

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1. Can you easily find the e-mail address of anyone in your office, in NOS, in NOAA and apply it to your e-mail?

Can you easily add incoming addresses to your e-mail address book? Can you easily add other addresses to a personal e-mail address book?

Do you use or have problems with group addresses?

2. Can you send attachments with e-mail? Is there a size limitation? Can you receive them? Are there problems converting?
3. Does e-mail sometimes take an inordinate amount of time to get from/to you?
4. Do you have to use more than one address for other employees of NOS, for others outside of NOS? If so, why?
5. Are you using more than one e-mail application/client on your desktop? If so, why?



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## APPENDIX B. DESCRIPTION OF IMAP4 AND POP

The following information is provided as a technical background to our recommendation that NOS consider moving to an Web-based e-mail system.<sup>1</sup>

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### Comparing Two Approaches to Remote Mailbox Access: IMAP vs. POP

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There are several different approaches to building a distributed electronic mail infrastructure. Among them: shared file-system strategies, proprietary LAN-based protocols, the X.400 P7 protocol, and the Internet message access protocols. The purpose of this paper is to briefly consider the Internet-based protocols: POP (Post Office Protocol), DMSP (Distributed Mail System Protocol), and IMAP (Internet Message Access Protocol). Of the three, POP is the oldest and consequently the best known. DMSP is largely limited to a single application, PCMAIL, and is known primarily for its excellent support of “disconnected” operation. IMAP offers a superset of POP and DMSP capabilities, and provides good support for all three modes of remote mailbox access: offline, online, and disconnected. (See RFC-1733 for definitions.)

POP was designed to support “offline” mail processing. In the offline paradigm, mail is delivered to a (usually shared) server, and a personal computer user periodically invokes a mail “client” program that connects to the server and downloads all of the pending mail to the user’s own machine. Thereafter, all mail processing is local to the client machine. Think of the offline access mode as a kind of store-and-forward service, intended to move mail (on demand) from the mail server (drop point) to a single destination machine, usually a PC or Mac. Once delivered to the PC or Mac, the messages are then deleted from the mail server. Although the limitations of offline access have triggered interest in using POP in online mode, POP simply doesn’t have some of the functionality needed for high-quality online (or disconnected) operation. Indeed, POP’s “pseudo on-line” mode of operation, wherein client programs leave mail on the server, often depends on pervasive availability of a remote file system protocol in order for the

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<sup>1</sup> The following information was taken verbatim from  
<http://www.imap.org/imap.vs.pop.brief.html>.

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mail client to access or update saved-message folders or message state information such as status flags.

IMAP can also do offline processing, but its special strength is in online and disconnected operation. In online mode, mail is again delivered to a shared server, but the mail client does not copy it all at once and then delete it from the server. It's more of an interactive client-server model, where the client can ask the server for headers, or the bodies of specified messages, or to search for messages meeting certain criteria. Messages in the mail repository can be marked with various status flags (e.g. "deleted" or "answered") and they stay in the repository until explicitly removed by the user—which may not be until a later session. In short: IMAP is designed to permit manipulation of remote mailboxes as if they were local. Depending on the IMAP client implementation and the mail architecture desired by the system manager, the user may save messages directly on the client machine, or save them on the server, or be given the choice of doing either.

While offline and online mailers both allow access to new incoming messages on the mail server from a variety of different client platforms, the similarities stop there. The two paradigms reflect different requirements and styles of use and they don't mix very well. Offline works best for people who use a single client machine all the time; it is not well-suited for the goals of accessing one's inbox of recent messages or saved-message folders from different machines at different times. That's because if you use offline ("download and delete") mail access from different computers at different times, your mail tends to get scattered across the different computers, unless they are all linked to a common network file system (in which case your access mode is really more online than offline.) On the other hand, the chief virtue of offline access is that it minimizes use of server resources and connect time when used via dialup.

Summarizing the differences between online and offline access paradigms:

- ◆ Offline and online paradigms reflect two distinct modes of use:
  - Offline = on-demand retrieval to a single client machine.
  - Online = interactive access to multiple mailboxes from multiple clients.
- ◆ Offline paradigm advantages:
  - Minimum use of connect time.
  - Minimum use of server resources.
- ◆ Online paradigm advantages:
  - Ability to use different computers at different times.

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- Ability to use “data-less” client machines, as in labs.
  - Platform-independent access to multiple mailboxes.
  - Possibility of concurrent access to shared mailboxes.

The essential point is that with the online paradigm, one’s incoming and archive message folders are stored on a server and may be accessed uniformly from different computers at different times, without relying on general purpose file system protocols (which are not uniformly available on all platforms, and which may also introduce performance and file locking problems). This is not an important goal for those who always use the same computer to access their email, but it is a very important one for those who use multiple computers.

With that background, here is a brief comparison of POP and IMAP technologies:

- ◆ Characteristics common to both POP and IMAP:
  - Both can support offline operation.
  - Mail is delivered to a shared, “always up” mail server.
  - New mail accessible from a variety of client platform types.
  - New mail accessible from anywhere in network.
  - Protocols are open; defined by Internet RFCs.
  - Freely available implementations (including source) available.
  - Clients available for PCs, Macs, and Unix.
  - Commercial implementations available.
  - Internet oriented; no SMTP mail gateways required.
  - Protocols deal with access only; both rely on SMTP to send.
  - Both support persistent message IDs (for disconnected operation).
- ◆ POP protocol advantages:
  - Simpler protocol; easier to implement.
  - More client software currently available.

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- ◆ IMAP protocol advantages:
    - Can manipulate persistent message status flags.
    - Can store messages as well as fetch them.
    - Can access and manage multiple mailboxes.
    - Can support concurrent updates and access to shared mailboxes.
    - Suitable for accessing non-email data; e.g., NetNews, documents.
    - Can also use offline paradigm, for minimum connect time and disk use.
    - Companion protocol defined for user configuration management (IMSP).
    - Constructs to permit online performance optimization, especially over low-speed links.

Elaborating on these points:

IMAP can manipulate persistent message status flags. These include flags such as “Seen”, “Deleted”, “Answered”, as well as user-defined flags.

IMAP can store messages as well as fetch them. One can append a message from an incoming message folder to an archive folder (or vice versa).

IMAP can access and manage multiple mailboxes. This includes the ability to name and access different incoming and archive message folders, but also the ability to list, create, delete, and rename them. These mailboxes can be on the same server or on different servers. An IMAP client may allow you to see them at the same time, and move messages from one to the other.

IMAP can support concurrent updates and access to shared mailboxes. This capability is useful when multiple individuals are processing messages coming into a common inbox. Changes in mailbox state can be presented to all concurrently active clients via IMAP.

IMAP is suitable for accessing non-email data; e.g., NetNews, documents. This is handy for uniformly accessing different classes of information.

IMAP can also support the offline paradigm, for minimum connect time and server resources. The offline paradigm is useful in situations where the only access to a mail server is via expensive dialup connections and multi-platform

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access to one's mailboxes is not needed. It is also useful in environments where client machines are resource-rich and servers are resource-poor. Not all IMAP clients offer good offline processing support, but the protocol is certainly capable of it.

IMAP has a companion protocol defined for user configuration management called IMSP, the Internet Message Support Protocol. IMSP permits location-independent (multi-platform) access to personal configuration data such as address books.

IMAP has constructs to permit online performance optimization, especially over low-speed links. These include the ability to fetch the structure of a message without downloading it, to selectively fetch individual message parts, and the ability to use the server for searching in order to minimize data transfer between client and server.

Especially when connecting to a mail server via low-bandwidth lines, it is useful to be able to defer transferring messages or parts of messages that are not of immediate interest until a more propitious time. With multimedia or multipart MIME messages, transferring selected parts of a message can be a huge advantage, as when one is in a hotel room and has just received a short text message with a 10MB video clip attached. Efficient processing of MIME messages is a significant advantage of IMAP over POP. (MIME stands for Multipurpose Internet Mail Extensions. It is the Internet standard method for sending arbitrary files as attachments to SMTP and RFC-822 compatible Internet mail messages.)

In summary, IMAP offers advantages over POP in three areas: richer functionality in manipulating one's inbox, the ability to manage mail folders besides one's inbox, and primitives to allow optimization of online performance, especially when dealing with large MIME messages.

Because there are freely available IMAP development libraries, its additional complexity over POP should not be a significant barrier to use. Therefore, a reasonable conclusion is that the only advantage of POP over IMAP is that there is currently more POP software available. However, this is changing rapidly, and IMAP's functional advantages over POP are nothing less than overwhelming.

POP3 is defined in RFC-1725 and IMAP4 is defined in RFC-1730.

A current list of IMAP products may be found at <http://www.imap.org/products.html>, and a listing of documents relevant to IMAP at <http://www.imap.org/biblio.html>.

Also available in the/mail directory of <ftp.cac.washington.edu> is a POP server that, in addition to offering the normal POP service, can relay commands to an IMAP server, thus permitting existing POP clients to access an IMAP server.

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Also of potential interest are

<http://www.imap.org/imap.docs.html> (a compilation of IMAP documents); and

Message Access Paradigms and Protocols, which is an elaboration of this note, providing more background information and detail on POP and IMAP in the context of online message access.

*The IMAP Connection*

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